Amber McCullum
NCTS# 25415-17 AGU Fall Meeting 2016

California Reservoir Inflow Projections Using a Hybrid EMD-Matalas Method

Inflow projections provide scenarios for future water availability and are integral to operational reservoir management. They can aid water practitioners in decision-making for conservation efforts, multiyear storage retention, managing flood risk, downstream water releases, and regional growth planning. However, conventional methods are often limited in terms of their ability to incorporate non-stationarity, long run persistence, and the cross-correlation of multiple series in a region. This research aims to address these issues with a hybrid approach that integrates Empirical Mode Decomposition (EMD) with the Matalas multisite generation method. Multiple long-run inflows were examined for the Shasta/Trinity Reservoirs and Oroville Reservoir of California. EMD is used to decompose each inflow series into a set of independent intrinsic mode functions (IMFs) that have different timescales and frequencies. These IMFs were grouped into intradecadal (<10-year average periodicity) and interdecadal (>10-year average periodicity) series for each site. The IMF projections at each site were then combined to produce replicates of the historical data. This preserves the correlation structure of the intra- and interdecadal components of the series. The hybrid EMD-Matalas method was compared to a traditional autoregressive lag-one [AR(1)] model. Both methods were found to retain the statistical characteristics of the historical data. However, the EMD-Matalas method retained the multiyear wet and dry periods to a greater degree. This was examined by comparing the 5-year and 10-year sums from the traditional model with the hybrid EMD-Matalas model. An advantage of the EMD-Matalas method is the ability to explicitly incorporate modes of non-stationary long-run persistence often associated with large-scale climate drivers such as the El Niño Southern Oscillation (ENSO) or the Pacific Decadal Oscillation (PDO). This contributes to scenario planning that may be particularly important for managing multiyear low flow periods.

Authors

- Amber Jean Kuss McCullum
  - Bay Area Environmental Research Institute Moffett Field
  - University of California Santa Cruz
- Renée Kidson
  - University of California Santa Cruz
- Brent Haddad
  - University of California Santa Cruz